

RESEARCH

PATENT SPECIFICATION

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COMPLETE SPECIFICATION.

Improvements relating to Control Equipment for Electric Motors.

We, METROPOLITAN-VICKERS ELECTRICAL COMPANY LIMITED, of St. Paul's Corner, 1-3, St. Paul's Churchyard, London, E.C.4, a British Company, do hereby declare this invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

10 This invention relates to control equipment for electric motors driving slow-moving apparatus and has an important application in driving chain-grate stokers for boilers.

It will be appreciated that with chain-grate stokers the speed of travel is relatively slow, the speed normally being reckoned in feet per hour. Existing methods of speed control employ either an A.C. commutator motor or a constant speed A.C. squirrel cage motor with a speed change device such as a gear box or slipping clutch in the transmission.

These arrangements are costly to instal, and only the first-mentioned method is suitable for control from the boiler control board.

The main object of the present invention is to provide improved equipment which is cheaper to instal and provides a satisfactory control of average stoker speed.

The present invention comprises control equipment for an A.C. electric motor or motors driving apparatus at slow speed, said equipment including a plurality of on-off switches each adapted for continuously recurring operation between on and off positions, and each having a different ratio of on-time to off-time, together with a selector device for connecting into a circuit controlling the supply to the motor or motors, the on-off switch having the ratio of on-time to off-time appropriate to the required average speed of the motor or motors.

Preferably the on-off switches are rotary switches driven at constant speed from a pilot motor, and are closed for different lengths of time in each revolution. The

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rotary switches may, for instance, be cam-operated or may comprise commutator segments, the peripheral lengths of the commutator segments of which are varied to give the varying closing times. The cams or commutators may be arranged in a bank and mounted on a common shaft driven at a constant slow speed by the pilot motor through reduction gearing.

The selector device may comprise a multi-way selector switch which connects the required on-off switch in circuit. Normally the on-off switches will be graded so that the selector switch, in moving from an off position, connects the motor driving the stoker or other apparatus for progressively increasing the average speed, for instance if the on-off switches are driven at, say, one revolution per minute the on-off switches may close for, say, twenty, thirty, forty and fifty seconds respectively during each revolution.

The on-off switches may be in the main circuit to the motor if the latter is small. If, however, the current handled is appreciable it may be preferable for the on-off switches to control the circuit through the operating coil of the main contactor switch for the motor.

In order that the invention may be more clearly understood reference will now be made to the accompanying drawing the single figure of which illustrates schematically a form of control equipment in accordance with the invention.

Referring to the figure, a three phase electric motor 1, which may for example be coupled to drive a chain-grate stoker at a slow speed, is connected to the electric supply over a solenoid operated contactor 2. Also connected to the supply, by way of a switch 3, is a geared motor 4 adapted to drive, at, for example, one revolution per minute, a shaft 5 on which are mounted four rotary switches 6a, 6b, 6c, 6d. These switches are arranged to close for different lengths of time during each revolution; for instance switch 6a may be closed for one-

third of each revolution that is, in the example given where the shaft 5 rotates at 1 r.p.m., for 20 seconds in each minute; switch 6b may be closed for one-half of each revolution or 30 seconds in each minute; switch 6c for two-thirds of each revolution or 40 seconds per minute, and 6d for five-sixths of each revolution or 50 seconds per minute. A multi-way switch 7 has an off position, a maximum ("max") position and four intermediate positions. In the "off" position the operating solenoid 8 of the contactor 2 is de-energised so that the contactor 2 remains open and the motor 1 does not operate. In the "max" position of the switch 7, the solenoid 8 is connected directly across two phases of the supply so that the contactor 2 is maintained closed and the motor 1 rotates continuously. At the intermediate positions of the switch 7, the solenoid 8 is connected across the two phases of the supply through one or other of the rotary switches 6a, 6b, 6c, 6d so that the solenoid 8 will be intermittently energised as the rotary switches rotate and the motor 1 will, as a consequence, rotate intermittently with an overall average speed which will depend on the rotary switch selected.

Whilst the control equipment of the invention drives the stoking or other apparatus intermittently, it has been found that in stoking apparatus such movement is quite suitable since the average rate of movement even at maximum speed is so small that the effect of intermittent movement on the firebed is negligible.

What we claim is:—

PROVISIONAL SPECIFICATION.

Improvements relating to Control Equipment for Electric Motors.

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This invention relates to control equipment for electric motors driving slow-moving apparatus and has an important application in driving chain-grate stokers for boilers.

It will be appreciated that with chain-grate stokers the speed of travel is relatively slow, the speed normally being reckoned in feet per hour. Existing methods of speed control employ either an A.C. commutator motor or a constant speed A.C. squirrel cage motor with a speed change device such as a gear box or slipping clutch in the transmission.

These arrangements are costly to instal, and only the first-mentioned method is suitable for control from the boiler control board.

The main object of the present invention

1. Control equipment for an A.C. electric motor or motors driving apparatus at a slow speed, including a plurality of on-off switches each adapted for continuously recurring operation between on and off positions, and each having a different ratio of on-time to off-time, together with a selector device for connecting into a circuit controlling the supply to the motor or motors, the on-off switch having the ratio of on-time to off-time appropriate to the required average speed of the motor or motors.

2. Control equipment as claimed in Claim 1 in which the on-off switches comprise rotary switches driven at a constant speed from a pilot motor, said switches being closed for different lengths of time in each revolution.

3. Control equipment as claimed in Claim 1 or Claim 2 in which the on-off switches are cam-operated.

4. Control equipment as claimed in Claim 2, in which the on-off switches comprise commutator segments the peripheral lengths of the conductor segments of which are varied to give the different on/off ratios.

5. Control equipment as claimed in any preceding claim, in which the selector device comprises a multi-way selector switch by which the required on-off switch may be connected in circuit.

6. Control equipment substantially as herein described with reference to the accompanying drawing.

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is to provide improved equipment which is cheaper to instal and provides a satisfactory control of average stoker speed.

The present invention comprises control equipment for an A.C. electric motor or motors driving apparatus at a relatively slow speed and including a plurality of on-off switches controlling the supply to said motor, which switches are adapted for continuously recurring operation between on and off positions and with individual switches having different relative on-off times, together with a selector device to select the on-off switch to give the required average speed of the motor or motors.

Preferably the on-off switches are rotary switches driven at constant speed by a pilot motor, individual switches being closed over different periods of each revolution. The rotary switches may, for instance, be cam-operated switches or commutator segments, the peripheral lengths of the cams or conductor segments being varied to give the varying closing times. The cams or com-

mutators may be arranged in a bank and mounted on a common shaft driven at a constant slow speed by the pilot motor through reduction gearing.

- 5 The selector device may comprise a selector switch which connects the required rotary switch in circuit. Normally the rotary switches will be graded so that the selector switch, in moving from an off position, connects the motor driving the stoker or other apparatus for progressively increasing the average speed, for instance if the rotary switches are driven at, say, one revolution per minute the rotary switches may close for, 15 say, twenty, thirty, forty and fifty seconds respectively during each revolution.

The rotary switches may be in the main

circuit to the motor if the latter is small. If, however, the current handled is appreciable it may be preferable for the rotary switches to control the circuit through the operating coil of the main contactor switch for the motor.

Whilst the control equipment above described drives the stoking or other apparatus intermittently, it has been found that in stoking apparatus such movement is quite suitable.

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